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(54) **Valve mechanism lubrication system for an overhead valve engine.**

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DE-A-2 641 944
FR-A-1 002 437
US-A-1 734 007
US-A-2 366 701
US-A-3 456 759
US-A-4 470 389

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Description

This invention relates to a breather induced lubrication system for the upper valve mechanism of an overhead valve, single cylinder, four stroke, internal combustion engine, as per the preamble of claim 1.

FR—A—1 002 437 discloses a lubrication system as per the said type. Thereby, oil vapors rise from the crankcase through a rocker arm passage into a rocker box, from which the vapors then return to a breather, and from there to a settling capacity reservoir, and then the oil returns to the crankcase by way of an oil orifice. There is a baffle in the rocker box for directing the oil mist.

US—A—2 366 701 discloses a system, whereby a baffle maintains a pool of oil, on one side thereof, which overflows to the other side and returns through a tube to the engine. This does not perform satisfactorily due to several problems. First of all, when the engine is oriented in the head down attitude, oil will not drain from the rocker box to the oil sump thus causing oil to build up in the rocker box. As enough oil builds up the breather will pump oil from the rocker box to the exterior of the engine. This is unsatisfactory because of oil spillage on and around the engine and the loss of lubricating oil which can result in engine failure due to lack of lubrication.

One solution to the above problems is to use a scavenging pump to remove the liquid oil from the rocker box and thereby prevent the build up of liquid oil therein. However, the provision of such a pump adds to the cost of the engine which is unsatisfactory.

US—A—4 470 389 discloses a lubrication system based on a similar principle: the pressure/vacuum produced in the crankcase by the horizontal piston stroke causes oil mist to move up to the parts to be lubricated and back to the oil sump through the breather.

US—A—3 456 759 and US—A—1 734 007 describe the use of hollow tubes housing push rods for circulating lubricating oil mist between rocker box and crankcase. Such systems are unsatisfactory, because of the cost of providing the required oil pumping mechanism and furthermore because a separate breather mechanism is required to vent the crankcase.

It is therefore desired to provide a simple, effective valve mechanism lubricating system whereby lubrication is induced by the breather. It is furthermore desired to provide a valve lifter actuation mechanism whereby oil mist in the crankcase is induced by the breather to flow past and thereby lubricate the rocker mechanism, then to be conducted to the breather for venting to the atmosphere, wherein condensed oil is drained back to the oil sump.

The present invention overcomes the disadvantages of the above described prior art lubrication systems by providing an improved breather induced lubrication system therefor, as per the characterizing features of claim 1.

The invention, in one form thereof, provides an internal combustion engine valve lifter mechanism lubricating system wherein one push rod tube conducts oil mist from the crankcase to the rocker box and a second push rod tube conducts oil mist and condensed liquid oil from the rocker box to a breather chamber. The breather chamber is vented through a breather valve mechanism to the atmosphere and is also connected by a drain passage to the oil sump. Liquid oil drains from the breather chamber to the oil sump through the drain passage.

The present invention, in one form thereof, provides a loop circuit from the crankcase to the oil sump whereby oil mist is induced to flow by the breather toward the rocker box through one push rod tube and is then caused to flow over the valve actuating mechanism by means of a baffle which is located in the rocker box. Oil mist and condensed liquid oil are then induced to flow from the rocker box toward the breather chamber through a second push rod tube. The breather chamber is vented through a valve mechanism to the atmosphere. Liquid oil collected in the breather chamber will drain back to the oil sump due to the greater pressure in the breather as compared to the low pressure generated in the crankcase.

Another advantage of the lubrication system according to the present invention is that the valve rocker mechanism is lubricated without the need for additional pumps to pump oil from the sump to the rocker box nor requires a scavenging pump to remove the oil from the rocker box when used in the horizontal cylinder mode with the crankshaft in a vertical position.

A still further advantage of the present invention is that engines incorporating the lubrication system of the present invention may be oriented in head down attitudes without causing oil to be pumped out of the breather.

Yet another advantage of the present invention is that it is simple in construction and low in cost yet very effective in lubricating the valve lifter mechanism.

The invention, in one form thereof comprises a lubrication system for the valve actuating mechanism of an internal combustion engine which includes a crankcase, a breather chamber and a rocker box for housing the valve actuating mechanism. A first hollow push rod tube which houses a first push rod has one end open to the crankcase and an opposite end open to the rocker box whereby oil mist is conducted from the crankcase to the rocker box for lubrication of the valve actuating mechanism. A second hollow push rod tube which houses a second push rod has one end open to the rocker box and an opposite end open to the breather chamber for conducting oil mist and liquid oil from the rocker box to the breather chamber. The breather box includes a vent for venting the breather chamber to the atmosphere. A drain is provided for draining liquid oil which collects in the breather chamber to the oil sump.

It is an object of the present invention to provide a valve lifter mechanism lubrication system whereby oil mist is caused to flow from the crankcase in a loop circuit to lubricate the valve lifter mechanism and whereby liquid oil is induced by the breather to drain back from the valve lifter mechanism to the crankcase.

It is another object of the present invention to provide a breather induced valve lifter mechanism lubrication system whereby an engine incorporating the system and with the breather on top of the rocker cover may be oriented in head down attitude without causing oil to be pumped through the breather out of the engine.

Yet another object of the present invention is to provide a valve lifter lubrication system which is economical and effective.

The above mentioned and other features and objects of this invention and the manner of attaining them will become more apparent and the invention itself will be better understood by reference to the following description of an embodiment of the invention taken in conjuction with the accompanying drawings, wherein:

Fig. 1 is a plan view in cross section of the valve actuation and breather system;

Fig. 2 is an elevational sectional view of the valve actuation and breather system of Fig 1;

Fig. 3 is a partially broken away elevational view of the value actuation and breather system of Fig. 11;

Fig. 4 is an enlarged sectional end view of the rocker box and valve actuating mechanism taken along line 4—4 of Fig. 1;

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

The exemplifications set out herein illustrate a preferred embodiment of the invention, in one form thereof, and such exemplifications are not to be construed as limiting the scope of the disclosure or the scope of the invention.

Referring now to Figs. 1 and 2 an engine 10 is shown including a crankcase 12 and a cylinder 14. The engine includes cooling fins 16 disposed around cylinder 14. A valve 18 in cylinder 14 operates in a conventional manner to selectively permit entry of fuel into cylinder 14 as is conventional. Another valve (not shown) is provided for exhausting combustion products from cylinder 14. A valve actuating mechanism is shown including a tappet 20 which is operated by a cam and a cam shaft (not shown) in a conventional manner. The tapet operates on a push rod 22 which is reciprocably housed in push rod tube 24. As best seen in Fig. 2 two valve actuating mechanisms are provided for the inlet and exhaust valves 18 respectively.

A valve rocker mechanism 26 is housed in a rocker box 27 comprised of a rocker box base 28 and a rocker box cover 29. The rocker box cover 29 is retained on the rocker box base 28 by means of two fasteners 31 which engage with two threaded shafts 30 received in threaded apertures 32 in bushings 37 of crankcase 12. Fasteners 31 are threaded into apertures in the ends of shafts 30. Rockers 38 are retained on shafts 30 by means of washers 34 and nuts 35 whereby rockers 38 can rock or pivot in response to actuation of push rods 2 by tappets 20. Therefore as push rods 22 are actuated by tappets 20, the actuating ends 40 of push rods 22 will operate on rockers 38 to cause rockers 38 to pivot and thereby actuate valve stems 44 of valves 18. Springs 46 are provided for biasing valves 18 into their normally closed positions. Valve stem bushings 48 operate as bearings for stems 44 and as guides for valve springs 46.

By referring to Fig. 4 it can be seen that rocker box base 28 includes a groove 54 into which a flanged portion of rocker box cover 29 is retained. Additionally a seal 56 is located in groove 54 whereby cover 29 of rocker box 27 is sealingly engaged with base 28 of the rocker box so that no oil mist escapes from rocker box 27 externally of the engine. Rocker box 27 also includes a baffle 58, secured to rocker box base 29. A plate 60 is supported on bushings 37 and retained in place by nuts 61, two of which are provided, and which engage with threaded shafts 30. Plate 60 includes a pair of upstanding flanges 62 for guiding push rods 22. A pair of apertures 64 and 66 are shown in rocker box base 28 on either side of baffle 58 through which push rods 22 extend from push rod tubes 24 into rocker box 27. Additionally, a pair of apertures 68 are shown in bushings 48 through which valve stems 44 of valves 18 extend into rocker box 27.

Referring again to Figs. 1 and 2, it can be seen that push rod tubes 24 are sealed to rocker box 27 by means of O-rings 74 and annular flanges 75. Additionally push rod tubes 24 are sealed to crankcase 12 by means of O-rings 76 and annular flanges 77. The upper push rod tube 24, as shown in Fig. 2, is open to the crankcase by means of aperture 78 whereby oil mist can flow from crankcase 12 into upper push rod tube 29 tube as shown by arrows 79. Lower push rod tube 24, as shown in Fig. 2, opens into the interior of a breather 82 comprising a breather chamber 84. Oil mist can therefore travel from rocker box 27 to breather chamber 84 as shown by arrows 80. Breather 82 also includes a disc valve 86 as best shown in Fig. 1, whereby breather chamber 84 is vented to the atmosphere through disc valve 86 and vent tube 88 as best shown in Figs. 1 and 3. Breather chamber 84 communicates with an oil sump 92 in crankcase 12 by means of a drain passage 90. Breather chamber 88 is closed by means of a breather cover 94.

The disc valve 86 comprises a check valve whereby the breather chamber is vented to the atmosphere and pressures in crankcase 12 above atmospheric pressure are relieved through breather 82 as shown by arrow 83. However, when the crankcase pressure goes slightly below atmospheric pressure by operation of the piston in cylinder 14, check valve 86 will close off breather chamber 84 thereby preventing a flow of air into breather chamber 84 from the ambient

atmosphere. The provision of drain passage 90 in crankcase 12 will assist liquid oil, which collects in chamber 84, to drain therefrom and through conduit 90 into oil sump 92 when the crankcase pressure falls below atmospheric pressure, since the pressure in breather chamber 84 is normally at substantially atmospheric pressure. Liquid oil will therefore be aided in draining through drain passage 90 into oil sump 92 as shown by arrows 81. Oil drain passage 90 is preferably made rather small whereby a difference of pressure may exist across passage 90 without rapid pressure equalization between chamber 84 and oil sump 92.

In operation, when the engine piston is in its downward stroke in cylinder 14 and compresses the gas in crankcase 12, crankcase oil mist will travel out of the crankcase 12 through aperture 78 and through upper push rod tube 24 as shown in Fig. 2 and aperture 64 into rocker box 27. The oil mist which enters rocker box 27 will be forced by baffle 58, as best shown in Fig. 4, to flow past the valve actuating mechanism 26 for lubrication thereof as shown by the arrows. Without baffle 58 the oil mist would shortcircuit the valve mechanism 26 and would flow directly from inlet 64 to outlet 66 without contacting mechanism 26. Since rocker mechanism 26 is cooler than the oil mist, some of the oil mist will condense in the rocker box. This condensed oil mist will drain through lower push rod tube 24 into breather chamber 84. Additionally, the remaining oil mist in rocker box 27 will travel through lower push rod tube 24, as indicated by arrows 80, to the breather chamber 84. As shown by arrow 83 some oil mist will be vented out of breather chamber 84 to the atmosphere when the pressure in breather 82 exceeds atmospheric pressure. Liquid oil which collects in breather chamber 84 will drain to oil sump 92 by means of drain passage 90 as shown by arroes 81. This draining action occurs because of pressure differential across drain passage 90 during the upward stroke of the piston which tends to create a vacuum in the crankcase.

What has therefore been shown is a breather induced lubrication system for an engine valve actuating mechanism whereby the valve actuation mechanism is lubricated by inducement from the breather as oil mist will flow in loop circuit from crankcase 12 through push rod tubes 24 and the rocker box 27 to lubricate the valve actuating mechanism 26 therein and will then return to the breather 82 for venting to the atmosphere by vent tube 88. Condensed oil in breather 82 will drain back to oil sump 92.

Claims

1. A lubrication system for the valve actuating mechanism (26) of an internal combustion engine comprising: a crank-case (12) including an oil sump (92); a breather chamber (84); a rocker box (27) housing said valve actuating mechanism (26); first hollow push tube means (24) housing a first push rod (22), said first hollow push tube means (24) having one end open to said crankcase (12) and an opposite end open to the rocker box (27) whereby oil mist is conducted from said crank-case (12) to said rocker box (27) for lubrication of said valve actuating mechanism; second hollow tube means (24) having one end open to said rocker box (27) and an opposite end open to said breather chamber (84) conducting oil mist and liquid oil from said rocker box (27) to said breather chamber (84); vent means (88) venting said breather chamber (84) to the atmosphere; and drain means (90) draining liquid oil from said breather chamber (84) to said oil sump (92), characterized in that said second hollow tube means (24) houses a second push rod and in that a baffle means (58) is provided in the rocker box (27) for directing the oil mist past the valve rocker mechanism (26) as the oil mist flows through the rocker box (27), and by a plate (60) supported in said rocker box (27) and including upstanding flanges (62) for guiding said push rods (22).

2. The lubrication system of claim 1 wherein said drain means comprises a conduit (90) from said breather chamber (84) to said oil sump (92), the pressure differential across said conduit (90) causing liquid oil to flow from said breather chamber (84) to said sump (92).

3. The lubrication system of claim 1 including a check valve (86) in said breather chamber (84), said valve (86) operative to permit gas flow to the atmosphere from said breather chamber (84) and operative at a preselected pressure to prevent gas flow from said breather chamber (84) to the atmosphere.

4. The lubrication system of claim 1 including a vent tube (88) having one end thereof connected to said check valve (86) and the opposite end open to the atmosphere.

Patentansprüche

1. Ventilschmierungsanlage für den Ventilbetätigungsmechanismus (26) einer Brennkraftmaschine, umfassend: ein Kurbelwellengehäuse (12) mit einem Ölsumpf (92); eine Belüftungskammer (84); ein Kippgehäuse (27) zur Aufnahme des Ventilbetätigungsmechanismus (26); eine erste, der Aufnahme einer ersten Schubstange (22) dienende Schiebehülse (24), deren eines Ende gegen das Kurbelwellengehäuse (12), und deren anderes Ende gegen das Kippgehäuse (27) hin offen ist, wobei zwecks Schmierung des Ventilbetätigungsmechanismus Ölnebel vom Kurbelwellengehäuse (12) zum Kippgehäuse (27) geleitet wird; eine zweite Schiebehülse (24), deren eines Ende gegen das Kippgehäuse (27), und deren entgegengesetztes Ende gegen die Belüftungskammer (84) hin offen ist, um Ölnebel und flüssiges Öl vom Kippgehäuse (27) zur Belüftungskammer (84) zu leiten; mit einer Belüftungseinrichtung (88), die die Belüftungskammer (84) mit der Atmosphäre verbindet, sowie mit einem Auslaß (90) zum Ablassen von flüssigem Öl aus der Belüftungskammer (84) in den Ölsumpf (92), dadurch

gekennzeichnet, daß die zweite Schiebehülse (24) eine zweite Schubstange aufnimmt, daß ein Umlenkorgan (58) im Kippgehäuse (27) vorgesehen ist, um den Ölnebel zum Ventilkippmechanismus (26) zu leiten, wenn der Ölnebel durch das Kippgehäuse (27) strömt, sowie durch eine Platte (60), die im Kippgehäuse (27) gelagert ist und die aufrecht stehende Flansche (62) zum Führen der Schubstangen umfaßt.

2. Schmierungsanlage nach Anspruch 1, dadurch gekennzeichnet, daß der Auslaß eine Leitung (90) aus der Belüftungskammer (84) zum Ölsumpf (92) aufweist, und daß das Druckdifferential über die Leitung (90) flüssiges Öl dazu veranlaßt, aus der Belüftungskammer (84) in den Sumpf (92) zu fließen.

3. Schmierungsanlage nach Anspruch 1, dadurch gekennzeichnet, daß ein Rückschlagventil (86) in der Belüftungskammer (84) vorgesehen ist, und daß das Ventil derart arbeitet, daß es eine Gasströmung aus der Belüftungskammer (84) in die Atmosphäre erlaubt, und bei einem vorbestimmten Druckwert Gasströmung aus der Belüftungskammer (84) in die Atmosphäre unterbindet.

4. Schmierungsanlage nach Anspruch 1, dadurch gekennzeichnet, daß ein Belüfungsrohr (88) vorgesehen ist, desse eines Ende mit dem rücksrohr (88) vorgesehen ist, dessen eines Ende mit dem Rückschlagventil (86), und dessen entgegengesetztes offenes Ende mit der Atmosphäre verbunden ist.

Revendications

1. Système de graissage du méchamisme de manoeuvre de soupapes (26) d'un moteur à combustion interne, comprenant: un carter de moteur (12) comprenant un carter d'huile (92); une chambre de reniflard (84); une boîte de culbuteurs (27) logeant le mécanisme de manoeuvre de soupapes (26); un premier dispositif de tube de poussoir creux (24) logeant une première tige de poussoir (22); ce premier dispositif de tube de poussoir creux (24) comportant une extrémité ouverte vers le carter (12) et une extrémité opposée ouverte vers la boîte de culbuteurs (27), de façon qu'un brouillard d'huile soit conduit du carter (12) vers la boîte de culbuteurs (27) pour lubrifier le mécanisme de manoeuvre de soupapes; un second dispositif de tube creux (24) comportant une extrémité ouverte vers la boîte de culbuteurs (27) et une extrémité opposée ouverte vers la chambre de reniflard (84) pour conduire le brouillard d'huille et l'huile liquide de la boîte de culbuteurs (27) vers la chambre de reniflard (84); des moyens d'évent (88) pour décharger la chambre de reniflard (84) dans l'atmosphère; et des moyens d'écoulement (90) pour drainer l'huile liquide de la chambre de reniflard (84) vers le carter d'huile (92), système caractérisé en ce que le second dispositif de tube creux (24) loge une seconde tige de poussoir et en ce qu'un dispositif de déflecteur (58) est utilisé dans la boîte de culbuteurs (27) pour diriger le brouillard d'huile sur le mécanisme de culbuteurs de soupapes (26) lorsque ce brouillard d'huile passe par la boîte de culbuteurs (27) et par une plaque (60) montée dans la boîte de culbuteurs (27) et comportant des rebords en saillie (62) pour guider les tiges de poussoir (22).

2. Système de graissage selon la revendication 1, caractérisé en ce que les moyens d'écoulement sont constitués par un conduit (90) allant de la chambre de reniflard (84) au carter d'huile (92), la différence de pression entre les extrèmitès du conduit (90) provoquant l'écoulement de l'huille liquide de la chambre de reniflard (84) vers le carter d'huile (92).

3. Système de graissage selon la revendication 1, caractérisé en ce qu'il comprend un clapet de retenue (86) dans la chambre de reniflard (84), ce clapet de retenue (86) servant à permettre le passage d'un débit de gaz de la chambre de reniflard (84) vers l'atmosphère, et fonctionnant, à une pression prédéterminée, pour empêcher le passage du débit de gaz de la chambre de reniflard (84) vers l'atmosphère.

4. Système de graissage selon la revendication 1, caractérisé en ce qu'il comprend un tube d'évent (88) dont une extrémité est reliée au clapet de retenue (86) et dont l'extrémité opposée débouche dans l'atmosphère.

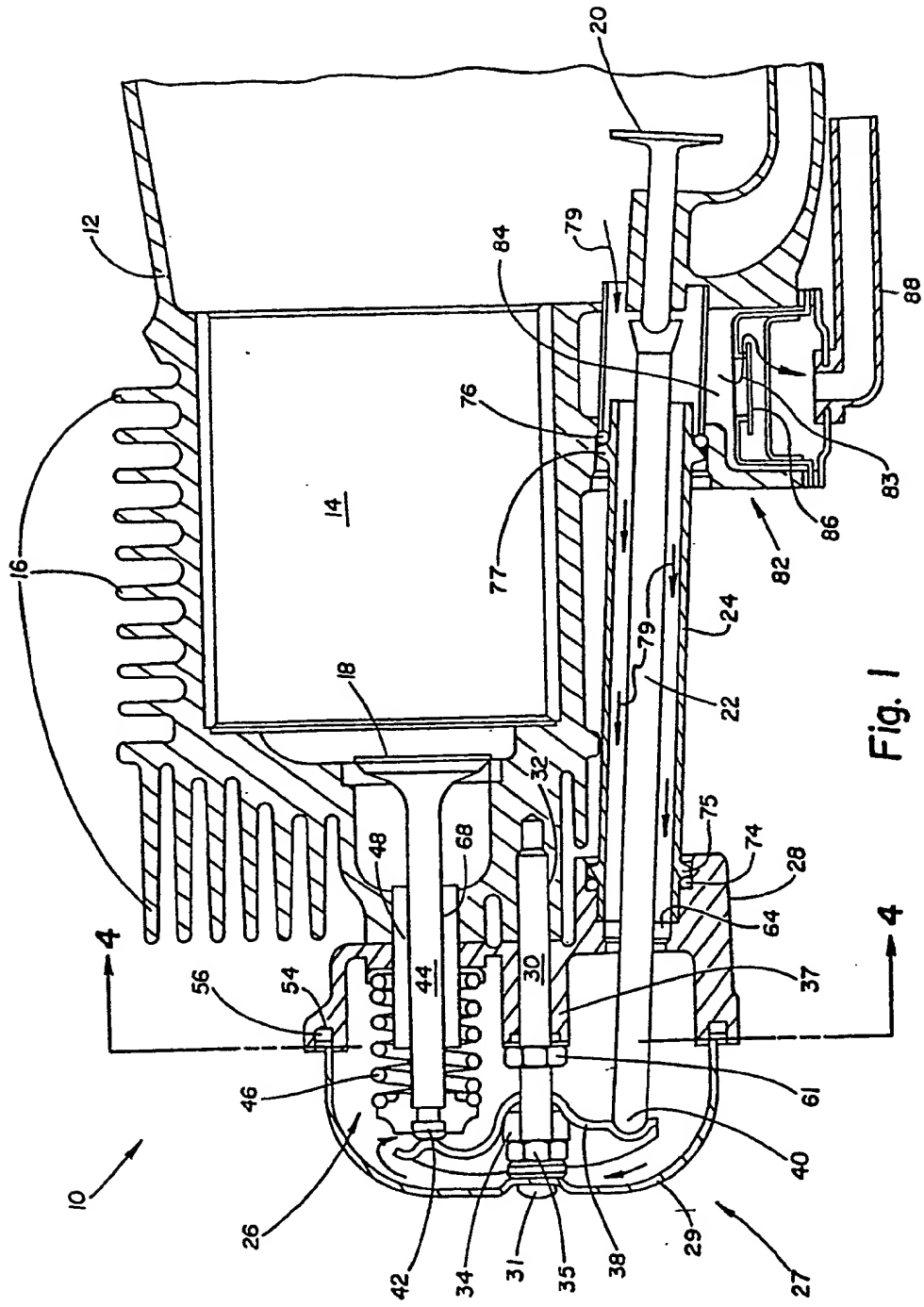
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Fig. 1

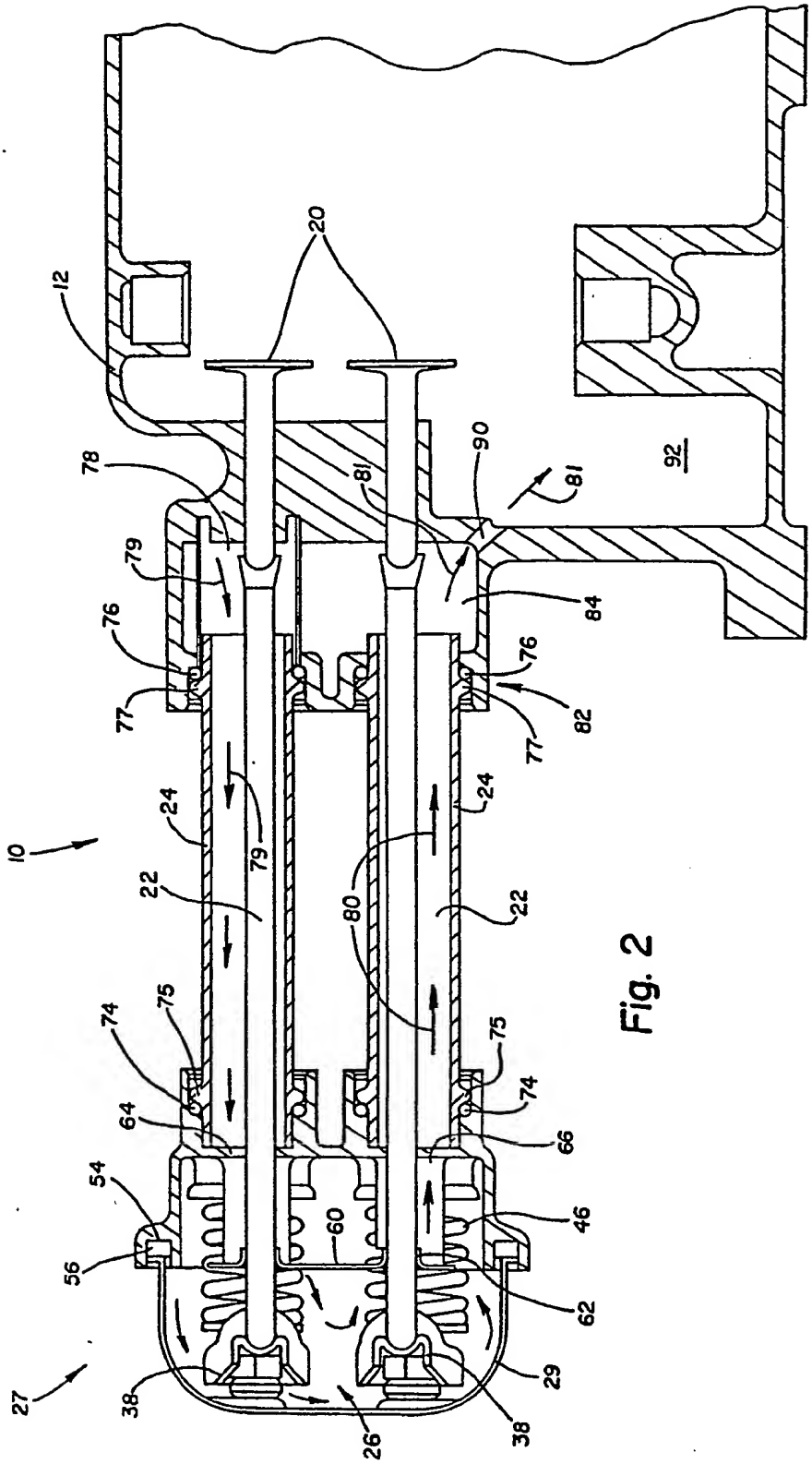
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Fig. 2

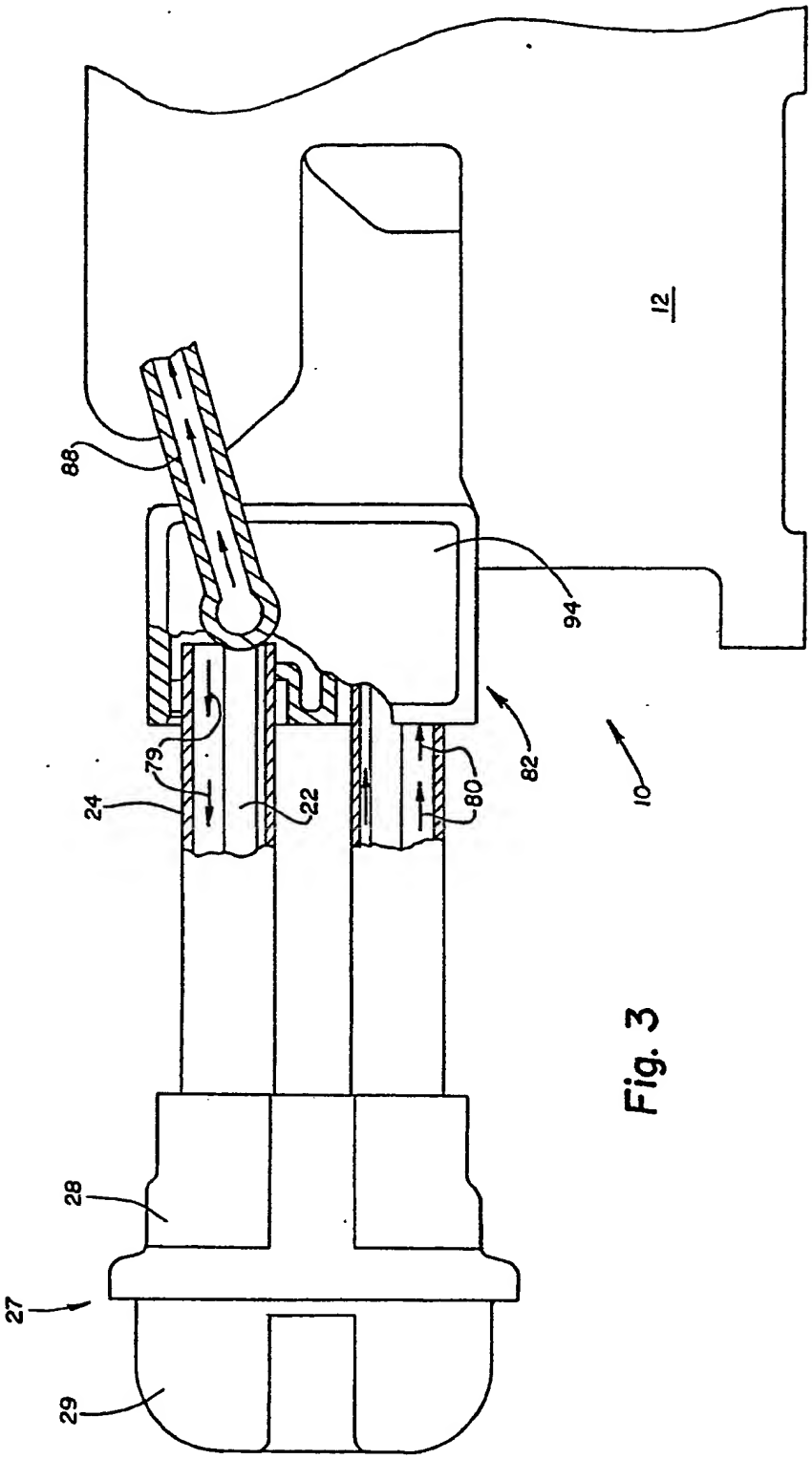

Fig. 3

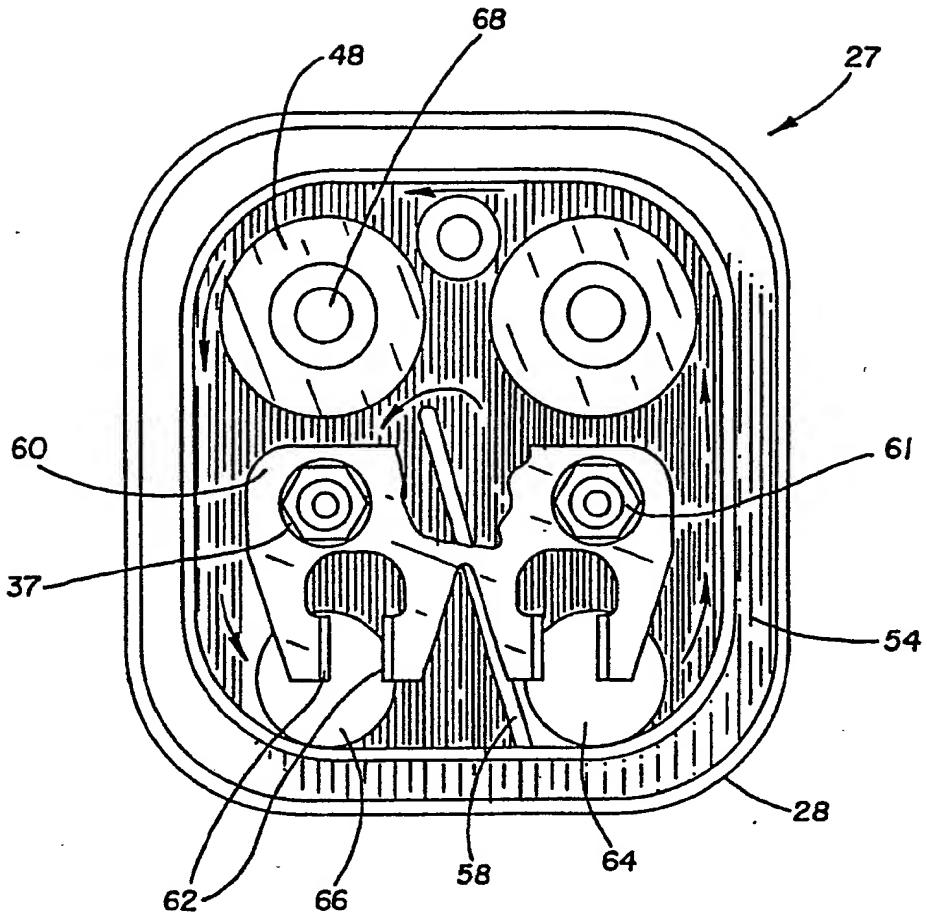

Fig. 4